



Innovation Research Teams Program

Interim Status Report

August, 2008

The Innovation Research Teams (IRT) program, authorized in 2007 by state statute, provides funding to support the recruitment of entrepreneurial researchers to Washington, individuals with the knowledge, skills and ability to generate research products and innovations with direct commercial applications. The program is meant to foster both product innovation and longer-term statewide economic development.

The IRT program also is designed to enhance entrepreneurial assistance programs targeted at research universities, key research-dependent industries and small businesses. The program received an initial appropriation of \$2.37 million in 2007 and a supplemental appropriation of \$265,000 in 2008 for a total of \$2.64 million for the biennium ending June 30, 2009. This report summarizes program implementation progress to date.

The IRT (also known as the Star Researchers program), follows a model in place in many other states. It is administered by the Washington Economic Development Commission (WDEC) with the support and assistance of the Washington Higher Education Coordinating Board (HECB).

Program Planning

The IRT's authorizing legislation required the HECB and WEDC to deliver two documents to the legislature by December 2007: 1) an *Innovation Opportunity Analysis* that described where the state's primary research assets reside and assessed their potential to produce commercial applications; and 2) an *Implementation Plan* for the IRT program for the next 10 years.

The *Innovation Opportunity Analysis* noted that Washington's two major public research institutions – the University of Washington and Washington State University – have state-of-the-science research capacity in the following key categories:

- **Clean Technology and Advanced Materials**, including Nanophotonics, Energy, and Environmental Monitoring/Sensors
- **Global Health** and Infectious Diseases at the Human-Animal Interface (Global Animal Health)
- **Human Health and Medicine**, including Molecular Medicine, Biomedical Devices, Chromosome and the Science of Reproduction, and Brain, Behavior and Performance
- **Molecular Plant Science and Genetics** (primarily WSU)
- **E-Science** (primarily UW)

The *Implementation Plan* recommended the immediate hiring of two researchers, one with expertise in biofuels engineering, who would lead a program at WSU-Tri Cities; the other with expertise in nanophotonics, who would lead a program at the UW.

The Implementation Plan also addressed a statutory requirement that the program develop 10 IRTs in 10 years. The *Implementation Plan* estimated the state's two research universities could support as many as 16 IRTs in this time period and proposed two funding alternatives: 1) increase annual funding to \$16 million a year by 2012 to achieve 10 IRTs; or (2) increase annual funding to \$26 million by 2016 to achieve 16 IRTs.

In January 2008, the WEDC approved the near-term portion of the plan for FY 08-09 (to hire the two 'star' reserchers) but deferred approval of the plan for FY 2010 and beyond, pending further review and revision.

The Nanophotonics Innovation Research Team

Between spring 2007 and winter 2008, the UW, with funding of \$1.3 million from the WEDC, laid the groundwork for developing a Nanophotonics Research Team. The science of nanophotonics has many potential commercial applications. For example, it can be used to achieve enormous leaps in the speed, energy efficiency and carrying capacity of data transmission cabling, memory and data processing chips and data storage and retrieval systems.

To lead the team, the UW recruited Professor Michael Hochberg to its Electrical Engineering Department from the California Institute of Technology. Hochberg is a prolific inventor who, while still an undergraduate at California Institute of Technology, co-founded Luxtera, a company that builds silicon chips with fiber-optic technology.

Tom Baehr-Jones, a UW Research Scientist, was hired to organize the startup of the new nanophotonics lab and direct the acquisition of equipment and supplies for research operations. Also joining the team was Boyan Penkov, an Engineering Technician at Cornell University (a collaborating institution with Dr. Hochberg). Mr. Penkov had been performing research work on behalf of the UW Nanophotonics Lab in conjunction with his graduate studies.

IRT equipment funding (\$1.3 million), UW research funding (\$1.2 million), and matching resources (\$1.35 million) from the Washington Research Foundation (WRF) and federal funding sources are being used to build a new \$4 million electron beam lithography laboratory. In addition, the Washington Technology Center has provided significant in-kind support for the research team by taking on the task of marketing the nanophotonics laboratory to the industry and research communities as a new tool available for their use. WTC has assigned a staff member to work directly with Dr. Hochberg and his industry partners to make sure the new laboratory achieves maximum utilization. To date, nearly 30 researchers and companies have expressed interest in using the facility, once it is completed and available for use.

The university has secured an additional \$607,000 in research grant awards for Dr. Hochberg and his team from NSF, Tektronix, and Intel. An additional \$1.6 million in research funding proposals to DARPA (USDoD) and the MJ Murdock Charitable Trust are currently in development or pending.

The following industry collaborations are underway or are currently being developed by Dr. Hochberg and his team:

- Boeing Commercial Aircraft is collaborating on developing chip scale photonics in silicon.
- Dan Ratner (BioE) and Genalyte Corp are collaborating on biological applications.
- There is strong emerging collaboration with BAE Systems.
- There is strong emerging collaboration with two Intel groups, one in Santa Clara and the other in Oregon. The Hochberg group will be carrying out fabrication in their fabrication lab.
- There is some emerging collaboration with Lumera.
- Fabrication is being carried out through Lincoln Labs in a program sponsored through the National Reconnaissance Office

In addition, the following patent disclosures have been submitted to the UW technology transfer office by Dr. Hochberg since January 2008:

ROI Reference Number	Title	Date Submitted	UW TechTransfer Reference Number
<u>250</u>	Phase Matching for Difference Frequency Generation and Nonlinear Optical conversion for planar waveguides via vertical coupling	July 18, 2008	8126D
<u>249</u>	A Method for enhancing photodetectors with grating couplers	July 18, 2008	8125D
<u>248</u>	Electroabsorption Modulator based on Fermi Level Tuning	July 18, 2008	8124D
<u>247</u>	Optical Rectification Detector with Boost Optical Mode enhancement	July 18, 2008	8123D
<u>246</u>	A method to Detect Radiation with a Nonlinear Phase Shift Mechanism	July 18, 2008	8122D
<u>206</u>	All Optical Modulation and Switching with patterned optically absorbing Polymers and other materials	May 15, 2008	8069D
<u>188</u>	Optical XOR Logic Gate based on a Single photon absorption process	April 23, 2008	8054D
<u>187</u>	An All-optical integrated photonic clock based on an optoelectronic transistor design	April 23, 2008	8053D
<u>157</u>	Waveguides and Devices for Enhanced third order nonlinearities in polymer-silicon systems	March 4, 2008	8022D
<u>112</u>	Enhanced silicon all-optical modulator	January 21, 2008	7980D

The goal for FY09 is to complete the construction and assembly of the electron beam lithography nanophotonics laboratory and begin operations. The UW also will work with its industry partners to develop plans to improve the commercialization potential of Dr. Hochberg's work and support technology transfer.

The Bioproducts/Bioenergy Innovation Research Team

Dr. Birgitte Ahring was hired by Washington State University – Tri Cities on Feb. 27, 2008 as the Director of the Center for Bioproducts and Bioenergy (CBB) and Battelle

Distinguished Professor. She began working part time on March 1 and will begin working full-time effective Aug. 15, 2008.

Dr. Ahring, a microbiologist recruited from the Technical University of Denmark, will work with industry in the state and with leaders in the federal government on the development and implementation of technologies and solutions to address clean technology needs in the state and to make Washington a national leader in the development of clean technologies.

Dr. Ahring started the Maxifuel pilot facility in Denmark, transforming cellulosic materials to high-value fuels and chemicals, and is CEO of BioGasol, ApS. Through Dr. Ahring's efforts, BioGasol recently received a \$24.3 million U.S. Department of Energy grant to build a cellulosic ethanol demonstration plant in Boardman, Oregon, using technology she developed in Denmark. It is expected Dr. Ahring will attract substantial additional federal funding to Washington.

Dr. Ahring's team at CBB will receive \$955,000 in IRT funding in FY08 and FY09. To date, more than \$750,000 in equipment for the Bioproducts, Sciences, and Engineering Laboratory (BSEL) has been purchased with IRT and other funds in anticipation of her arrival. All of the equipment has arrived and is being installed in laboratories and classrooms.

The CBB is slated to hire 10 faculty members/scientists who will have joint appointments with WSU and the Pacific Northwest National Laboratory. Position descriptions have been developed and recruiting will begin in September or October. The Center also will identify an Assistant Director, on a temporary basis for the next year, to support the BSEL startup activities and coordinate laboratory research efforts.

In January, the U.S. Department of Energy announced it would award Pacific Ethanol (a strategic partner of Dr. Ahring's BioGasol company) a matching grant totaling \$24.32 million to build the first cellulosic ethanol demonstration plant in the Northwest United States. The plant, which will employ a technology to produce ethanol from wheat straw, wood chips and corn stover, will be co-located in Boardman, Oregon. The Joint BioEnergy Institute (Lawrence Berkley National Laboratory and Sandia National Laboratory) is also a partner in the project.

Dr. Ahring's company has developed the proprietary technology and the Joint BioEnergy Institute will be providing support and specific research and development on enzyme technology. The pilot plant, which will be designed to produce 2.7 million gallons of ethanol annually, will demonstrate the potential of Dr. Ahring's technology to produce ethanol from biomass readily available in the local area.

Dr. Ahring is reviewing several additional funding opportunities and it is expected that grant proposals will be submitted over the next 8-10 months. She is currently developing a \$5 million proposal for the National Science Foundation's Science and Technology Center: Integrative Partnerships program (submission due date, Sept. 30, 2008).

On June 16, 2008, Rector Finn Kjærdsdam of Aalborg University in Denmark, signed an international agreement of cooperation with WSU. The agreement allows for student and faculty exchanges and collaborative research activities and projects. It is effective for five years and can be extended for additional years. As a result of this agreement, two doctoral students and one visiting scholar from AAU will study and collaborate with PNNL scientists and WSU faculty working in BSEL on enzymes and second-generation bioethanol production during the 2008-09 academic year.

WSU has scheduled first formal meetings between Dr. Ahring's team at BSEL and VC companies (Allied Minds, Integra), as well as Boeing, Weyerhaeuser, Imperium, Vulcan, and others—all which have expressed interest and plan to attend. Over the next year, WSU will be exploring the use of feed stocks from genetically designed next-gen vascular plants as well as other bio-feed stocks, including algae, to produce biofuels.

Continued Program Development Work

Over the next few months, the HECB and WEDC will be working with the institutions to develop an accountability and performance measurement framework for the IRT program. It is expected this work will be completed by January 2008. The partners also will be working to finalize the implementation and funding plan for the program and carry it forward to the Governor and the Legislature for the 2009 session.